Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

94-RPS-136

MAR 1 0 1994

Ms. Dru Butler, Program Manager
Nuclear and Mixed Waste Management
State of Washington
Department of Ecology
P.O. Box 47600
Olympia, Washington 98504-7600

Dear Ms. Butler:

REQUEST FOR CONCURRENCE WITH EMISSIONS EVALUATION FOR APPROVAL OF DEACTIVATION OF PUREX PLANT PURSUANT TO WASHINGTON ADMINISTRATIVE CODES 173-400 AND 173-460

This letter requests that the State of Washington Department of Ecology (Ecology), provide written concurrence with the conclusion reached in the enclosed document, "Evaluation Of Proposed PUREX Plant Deactivation Activities With Reference To Airborne Toxic Emission Releases," that approval is not required from Ecology prior to commencement of deactivation of the Plutonium Uranium Extraction (PUREX) Plant.

The Hanford Site includes a number of facilities that housed various processes associated with the Site's former mission. These facilities will eventually be deactivated, then decontaminated, and decommissioned. The PUREX Plant will be the first such major facility to undergo the deactivation process since enactment of the 1990 Clean Air Act Amendments. As such, the air emissions evaluation process established for PUREX deactivation activities will strongly influence the evaluation for similar activities at other Hanford Site Facilities.

Since March of 1990, PUREX has been in a standby/non-operational mode, with little or no emissions of toxic air pollutants (TAPs) or Prevention of Significant Deterioration (PSD) pollutants. Deactivation of PUREX may create emissions to atmosphere of TAPs and PSD pollutants. (In this case the PSD pollutant would be oxides of nitrogen [NO_x].) Therefore, it is expected that the TAPs and PSD emissions from deactivation activities may be greater than the TAPs and PSD emissions from PUREX during the years of non-operation. However, it is also expected that the emissions of TAPs and PSD pollutants from deactivation activities will not be greater than the TAPs and PSD emissions during normal PUREX operations and that the deactivation activity will not create, or cause to be emitted, any new TAPs or PSD pollutants from the PUREX Plant, when compared to normal operations. It is this comparison that provides the basis for the concurrence that is requested of Ecology.

Washington Administrative Code (WAC) 173-460-040(4) requires that, for any new TAPs source, Ecology review and approve a Notice of Construction. In turn, WAC 173-460-020(14) defines a "New toxic air pollutant source" as, "...any

alteration of any process...which may increase emissions...of any regulated air pollutant...." In finding a definition of an emissions increase, one is eventually referred to 40 Code of Federal Regulations (CFR) 52.21, "Prevention of Significant Deterioration of Air Quality." Section (3)(i) of 40 CFR 52.21, relates a "net emissions increase" to, "Any increase in actual emissions...." In turn, one finds "actual emissions" defined in 40 CFR 52.21(21)(i) as well as in WAC 173-400-030(1). In WAC 173-400-030(1)(a), "actual emissions" are defined as follows:

> "In general, actual emissions as of a particular date shall equal the average rate, in tons per year, at which the emissions unit actually emitted pollutant during a two-year period which precedes the particular date and which is representative of normal source operation. Ecology or the authority shall allow the use of a different time period upon a determination that it is more representative of normal operation. Actual emissions shall be calculated using the emissions unit's actual operating hours, production rates, and types of materials processed, stored, or combusted during the selected time period."

The release of NO_x to atmosphere from Hanford Site facilities is regulated by PSD Permit PSD-X80-14. This permit was issued by the U.S. Environmental Protection Agency (EPA) in October of 1980. The State of Washington regulates the release of NO_x to atmosphere pursuant to WAC 173-400.

In a letter, Ann Pontius, U.S. Environmental Protection Agency (EPA), to James Rasmussen, U. S. Department of Energy, Richland Operations Office (RL), dated August 25, 1993, EPA provided the following guidance, regarding the proposed released to atmosphere from PUREX, during deactivation, of approximately 300 to 400 metric tons of NO_x:

> "Since DOE has an active PSD permit which has evaluated best available control technology for the operation of the PUREX facility, and since there will be no changes that eliminate or bypass the control devices, EPA has determined that no modification to the federally issued PSD permit would be necessary to accommodate operation of the PUREX facility during the deactivation process.
>
> Note, however, that EPA has made no determination as to the applicability of the State of Washington requirements for...Significant Deterioration as set forth in WAC 173-400...You will need to obtain a determination from Ecology regarding the applicability of those regulations."

Deactivation is scheduled to commence in March of 1994. Typically, to develop applications pursuant to WAC 173-400 and WAC 173-460 and have those applications reviewed and approved by Ecology requires six months, or more. In the interests of expediting the clean up of the Hanford Site and the

deactivation of former processing facilities and in "re-inventing government," RL has developed the enclosed document which demonstrates that PUREX Plant TAP emissions from the proposed deactivation activities will not exceed past TAP emissions from the PUREX Plant during normal operations and that PSD emissions will not exceed the limits set forth in permit PSD-X80-14, and that, therefore, deactivation activities will not result in an emissions increase subject to prior approval by Ecology.

It is noted here that as a result of a January 31, 1994, discussion between Mr. Joe Witczak, Mr. Moses Jaraysi, and Mr. Bob King of your staff and Ms. Serap Brush, Ecology, Air Quality Section, and representatives of RL and the Westinghouse Hanford Company, Mr. Jaraysi has indicated that he and Mr. Witczak concur with the conclusion set forth in the attached document and agree that permitting pursuant to WAC 173-400 and WAC 173-460 is not required for the deactivation of PUREX.

Should you have questions regarding this request, please contact me or Mr. S. D. Stites of my staff on (509) 376-8566.

Sincerely,

James D Bauer

James D. Bauer, Program Manager
Office of Environmental Assurance,
Permits, and Policy

EAP:SDS

Enclosure:

cc w/encl:
S. Brush, Ecology
D. B. Jansen, Ecology
M. N. Jaraysi, Ecology
R. Nye, EPA
R. King, Ecology
D. G. Hamrick, WHC w/o encl.
J. Luke, WHC w/o encl.

Enclosure

ATTACHMENT 1

EVALUATION OF PROPOSED PUREX DEACTIVATION ACTIVITIES WITH REFERENCE TO POTENTIAL TOXIC AIR POLLUTANT RELEASES

1.0 INTRODUCTION

The U.S. Department of Energy, Richland Operations Office (RL) and Westinghouse Hanford Company (WHC) propose to start work towards final deactivation of the Plutonium Uranium Extraction (PUREX) Plant. In performing this work, emissions of toxic air pollutants (TAPs) may increase over TAPs emissions seen during the past four years of standby. However, it is projected that the increase in TAPs emissions will not exceed the TAPs emissions generated in 1988, the last year of normal plant operations.

Washington Administrative Code (WAC) 173-460-040(1)(c) states that:

> New source review of a modification is limited to the emission unit or units proposed to be modified and the emission unit or units whose emissions of TAPS may increase as a result of the modification.

Furthermore, WAC 173-400-030-(1)(a) states that:

> In general, actual emissions as of a particular date shall equal the average rate, in tons per year, at which the emissions unit actually emitted the pollutant during a two year period which precedes the particular date and which is representative of normal source operation. *Ecology or an authority shall allow the use of a different time period upon a determination that is more representative of normal source operation.* Actual emissions shall be calculated using the emissions unit's actual operating hours, production rates, and types of materials processed, stored, or combusted during the selected time period."

RL and WHC have performed a review of the draft PUREX/UO_3 Deactivation Project Management Plan (PMP; WHC 1993) which outlines how the PUREX Plant will be readied for final closure and decommissioning. The review was conducted assuming worst case non-accident release scenarios which could reasonably be proposed for each action item discussed in the PMP. The quantified projected non-radiological releases were compared with releases in 1988.

The conclusion of this review is that emissions of TAPs will not exceed emissions during "normal source operation." As a result of no emissions increase, New Source Review and subsequent permitting requirements do not apply to the proposed activity.

2.0 REVIEW OF TRANSITION ACTION ITEMS

This section describes nineteen proposed deactivation activities and discusses the emissions projected for each activity.

2.1 Contaminated Acid Disposal

Currently, the PMP discusses the proposed disposal of contaminated (nominal 10 molar) nitric acid using existing equipment to destroy the nitric acid via the sugar denitration process at a temperature of 95 to 98 °C. The PMP states that the nitric acid will be denitrated over a 240 to 320 day period

(Attachment 1). The processing time per 2500 gallon batch of 10 M nitric acid is about 72 hours. During the denitration of nitric acid, carbon dioxide and monoxide will also be generated. The denitration of nitric acid is thought to occur by the following different mechanisms.

$$C_{12}H_{22}O_{11} + 12\ HNO_3 \text{ ------> } 12\ CO + 6(NO + NO_2) + 17\ H_2O \quad (1)$$

$$CO + NO_2 \text{ -----> } CO_2 + NO \quad (2)$$

$$12\ HNO_3 + 24\ NO \text{ -----> } 18\ (NO_2 + NO) + 6\ H_2O \quad (3)$$

$$12\ HNO_3 + 12\ CO \text{ -----> } 6\ N_2O_3 + 12\ CO_2 + 6\ H_2O \quad (4)$$

$$24\ HNO_3 + 12\ CO \text{ -----> } 24\ NO_2 + 12\ CO_2 + 12\ H_2O \quad (5)$$

$$C_{12}H_{22}O_{11} + 48\ HNO_3 \text{ ------> } 12\ CO_2 + 48\ NO_2 + 35\ H_2O \quad (6)$$

The release of NO_x to atmosphere from Hanford Site facilities is regulated by Prevention of Significant Deterioration Permit PSD-X80-14. This permit was issued by the U.S. Environmental Protection Agency (EPA) in October of 1980. In a letter, Ann Pontius, EPA, to James Rasmussen, RL, EPA provided the following guidance, regarding the proposed released to atmosphere of approximately 300 to 400 metric tons of NO_x:

> "Since DOE has an active PSD permit which has evaluated best available control technology for the operation of the PUREX facility, and since there will be no changes that eliminate or bypass the control devices, EPA has determined that no modification to the federally issued PSD permit would be necessary to accommodate operation of the PUREX facility during the deactivation process."

A second option available for the disposal of the contaminated nitric acid is to reuse it in another nuclear-related activity in either the United States or a foreign country. To meet proposed acceptance criteria, it may be necessary to distill the nitric acid to reclaim the acid from the uranium bottoms. The distillation would be performed using the existing recovered nitric acid fractionator, T-U6, located in 206-A Facility at the PUREX Plant. The fractionator would be operated identically to past operations. Based on previous process knowledge, it is projected that emissions of NO_x from this activity would be below levels produced during normal plant operations, and below the limit set by PSD Permit PSD-X80-14.

2.2 Contaminated Solvent Disposal

Approximately 21,000 gallons of 25 volume percent Tri-Butyl Phosphate (TBP) in normal paraffin hydrocarbon (NPH) diluent have been transferred from G and R-Cells located in PUREX and into Tank 40. This was previously approved by Ecology on August 13, 1993. The solvent will eventually be loaded into tanker trailers from Tank 40 and transferred to either a commercial disposal facility or another U.S. Department of Energy site for use as a recycled material. Expected TAPs emissions for transferring the contents of Tank 40 to tanker trailers would not be any higher than the estimated TAPs emission for

transferring the solvent from G and R-Cells into tanker trailers. The calculations in Attachment 2 (reviewed and approved by Ecology prior to the August 13, 1993 approval) estimate that under worst case conditions, approximately 228 milliliters (0.5 pounds) of TBP would be released to the atmosphere from evaporation.

2.3 Single Pass Reactor Fuel Disposition

This deactivation activity deals with the movement of some very old aluminum clad irradiated fuel from the PUREX slug storage basin to the 105K East Storage Basin. Transportation will be by rail using 3-well cask cars and K basin fuel casks. This activity will be governed by procedures which are similar to those used during past routine PUREX fuel shipping operations.

Based on process knowledge and inventory data, it has been determined that there is no known source of TAPs associated with this activity. Therefore, no TAPs emissions are expected from this activity.

2.4 Slug Storage Basin Deactivation

The PMP provides a discussion of plans for laying-up the PUREX slug storage basin which was previously used to store aluminum clad fuel and contains approximately 53,000 gallons of water. Once the single-pass reactor fuel has been removed, the basin's water will be drained, and the walls and floors of the basin will be remotely flushed with additional water until radiation contamination levels on surfaces are sufficiently low to allow application of a surface coating fixative agent.

Again, based on process knowledge and inventory data, it has been determined that there is no known source of TAPs associated with this activity. Therefore, no TAPs emissions are expected from this activity.

2.5 N-Reactor Fuel Disposition

Another deactivation activity will recover spilled fuel from the floors of dissolver cells A, B, and C. Prior to removing the fuel with a special tool attached to the crane, equipment will have to be removed from each cell. Fuel from all three cells will be packaged, combined in one shipping cask and shipped to 105-K West Storage Basin, where it will be stored.

Again, based on process knowledge and inventory data, it has been determined that there is no known source of TAPs associated with this activity. Therefore, no TAPs emissions are expected from this activity.

2.6 Chemical Disposition

The PMP also discusses continuation of the successful campaign to sell surplus PUREX chemical stocks on the open market. Attempts will be made to sell the remaining 250,000 pounds of chemicals, but chemicals found to be unmarketable will ultimately be shipped offsite to a permitted disposal facility. During normal plant operations, approximately 2.3 million pounds of chemicals was stored at the PUREX facility.

In addition to selling the remaining chemicals, the tanks and piping will be rinsed and flushed, and the rinsate will be shipped to a permitted disposal facility. Since the quantity of chemicals in the plant is approximately nine times less than what existed on any given day during normal plant operations, the potential TAPs emissions will be below the levels generated during normal plant operations.

Surplus chemicals that are in sacks or drums would not be expected to have any potential releases during transport because they are contained.

2.7 Canyon Flushing

The PMP discusses a canyon flushing activity. The purpose of the flushing operation is to remove radioactive materials and acidic or basic residues from the system. The radionuclides removed will be mostly in the form of dissolved metal nitrate salts.

The flushing operation involves the initial transfer of an estimated 50,000 gallons of water solutions held in canyon vessels and 96,000 gallons in the P-tanks. This will be followed by the flushing with water of PUREX canyon vessels, piping, walls, and floors, which will generate an estimated 500,000 gallons of flush water.

Based on process knowledge and inventory data, it has been determined that nitric acid presents the only possible source of potential TAPs emissions (NO_x). Based on previous process knowledge, it is projected that emissions of NO_x from this activity would be below levels produced during normal plant operations, and below the limit set by PSD Permit PSD-X80-14.

2.8 In-Plant Waste Concentration

While it is presently planned to send the flush water from the canyon flushing operation to tank farms where it would be concentrated by the tank farm evaporator. There is also an option to send the flush liquids to PUREX's F11 evaporator for concentration prior to sending the waste to tank farms. This option would send the overheads from the evaporator into the canyon air stream, through the fiberglass and HEPA filters, and out of the main stack.

The only potentially toxic chemicals which may exist in the flush water would be non-volatile salts and nitric acid. The non-volatile salts would end up in the evaporator bottoms and would not be released to the air stream; however, NO_x might be formed in the F11 vapor stream. Based on previous process knowledge, it is projected that emissions of NO_x from this activity would be below levels produced during normal plant operations, and below the limit set by PSD Permit PSD-X80-14.

2.9 N-Cell Cleanout

The cleanout of the Plutonium Oxide Production Facility, commonly known as N-Cell, is described in the PMP. This area of the PUREX Plant contains the bulk of the special nuclear material (e.g., plutonium) which still remains at PUREX. Most of the readily-accessible plutonium that was present in N-Cell

has already been removed and sent to the Plutonium Finishing Plant. The amount of plutonium inventory remaining may be as high as 10 kg. Normal N-cell plutonium inventory was about 100 Kg, and the 1988 calendar year throughput was approximately 1,200 Kg.

The cleanout operation will involve removal of N-Cell equipment and piping by bagging out through gloveports. Some equipment will undergo size reduction to facilitate removal. When all the equipment has been removed, the glove boxes will be decontaminated, and a fixative agent will be applied to the surfaces.

Again, based on process knowledge and inventory data, it has been determined that there is no known source of TAPs associated with this activity. Therefore, no TAPs emissions are expected from this activity.

2.10 Metal Solution Disposition

Disposal of approximately 5,300 gallons of plutonium and uranium metal nitrate solutions stored in canyon tanks D5 and E6 is discussed in the PMP. These solutions consist of plutonium and uranium dissolved in one molar nitric acid which contains 1 to 4 grams/liter of cadmium used as a neutron poison. The first option is to mix the metal solution with plant flush solution and transfer the contents to tank farms.

A second option exists which involves precipitating the uranium, plutonium, and cadmium by adding sodium hydroxide to the solution. The precipitated solids would be drummed and treated as TRU waste.

Neither option provides a mechanism for the release of TAPs. Therefore, no TAPs emissions are expected from this activity.

2.11 Product Removal Room Deactivation

Because the Product Removal Room gloveboxes and tanks were flushed to remove the gross activity during transition of the plant to standby condition, the residual plutonium activity inventory is estimated to be extremely small. Any material which was loose and prone to air entrainment has been removed by flushing with water. The proposed approach for further deactivation includes removal of small equipment; size reduction of larger equipment, followed by removal; application of contamination fixatives to room and fixture surfaces, and possible glovebox removal.

Again, based on process knowledge and inventory data, it has been determined that there is no known source of TAPs associated with this activity. Therefore, no TAPs emissions are expected from this activity.

2.12 Zirconium Heel Stabilization

This activity, described in the PMP, involves the treatment of zirconium cladding fragments in the dissolver vessels with strong caustic solution to ensure that the metal surfaces are passivated with an oxide layer to eliminate the possibility of accidental pyrophoric ignition. Although the zirconium metal is believed to be oxidized now, this measure is being taken to provide

additional assurance that a metal fire in the dissolver vessels will not occur.

Again, based on process knowledge and inventory data, it has been determined that there is no known source of TAPs associated with this activity. Therefore, no TAPs emissions are expected from this activity.

2.13 Sample Gallery Deactivation

Deactivation of the sample gallery is discussed in the PMP. The sample gallery contains hoods, equipment, and piping as well as ventilation ductwork that are surface-contaminated. Normal PUREX Plant operation in the past has included periodic decontamination of the Sample Gallery, and operation maintenance of the process samplers. Proposed deactivation measures include flushing and application of surface fixative agents followed by removal of sample hoods and ventilation ducting.

Again, based on process knowledge and inventory data, it has been determined that there is no known source of TAPs associated with this activity. Therefore, no TAPs emissions are expected from this activity.

2.14 Q-Cell Cleanout

Q-Cell was used as a facility for purification of Neptunium-237, and was operated during the period 1958-1972. When this facility was shut down in 1984, it was flushed out many times; however, the maintenance room and hot cell are still highly contaminated with Neptunium-237 and its daughter products Protactinium-233 and Uranium-233. The cleanout approach to be used during deactivation will parallel that described earlier for the N-Cell and Product Removal Room deactivation. Equipment will be removed and packaged as waste.

Again, based on process knowledge and inventory data, it has been determined that there is no known source of TAPs associated with this activity. Therefore, no TAPs emissions are expected from this activity.

2.15 Pipe and Operating Gallery/White Room Deactivation

During normal plant operations, the Pipe and Operating Gallery (P & O) Gallery piping headers and tanks contained concentrated solutions of chemicals necessary for proper operation of the PUREX Process. The chemicals in the P & O Gallery are contained in piping headers and tanks that are isolated from the atmosphere. The proposed deactivation activities include the flushing and draining the piping headers and tanks, possible removal of some tanks, and application of a durable fixative agent to the floors to minimize maintenance.

Since the piping headers and tanks will be flushed until clean, and drained to the canyon tanks prior to dismantling, TAPs emissions will be less than the levels generated during normal plant operations.

2.16 Deactivation of Support and Ancillary Systems

Support and ancillary systems in several PUREX buildings will be deactivated. The affected buildings include but are not limited to PUREX buildings 293-A, 203-A, 206-A, 211-A, 205-A, 212-A, and 294-A. The PUREX Main Stack Monitoring Building, 292-AB, will receive some decontamination efforts, but will not be completely deactivated. Deactivation efforts will include the flushing and draining all vessels and piping, surface decontamination by washing/flushing, and sealing or painting to fix any residual radioactivity. The only toxic material that could be released is NO_x from deactivation of 203-A, 206-A, and 211-A. Based on previous process knowledge, it is projected that emissions of NO_x from this activity would be below levels produced during normal plant operations, and below the limit set by PSD Permit PSD-X80-14.

2.17 Utilities and Service Systems

This element of PUREX Plant deactivation involves the modification of utilities such as water, steam, electrical service, and fire suppression system in order to put these systems in a low maintenance mode. For example, blanking off the water main will minimize the probability of water intrusion into the facility in the case of a line failure.

Again, based on process knowledge and inventory data, it has been determined that there is no known source of TAPs associated with this activity. Therefore, no TAPs emissions are expected from this activity.

2.18 Ventilation System Consolidation

The ventilation system in the 202-A Building is designed and operated to keep normal work areas free of radioactive contamination by maintaining airflow from zones with little potential for contamination into zones of progressively greater contamination potential. The ventilation air is handled through four systems: canyon (system 1), Sample Gallery (system 2), service area (system 3) and laboratory (system 4). Control is provided by maintaining minimum differential pressures between the ventilation zones.

The current operation of the PUREX ventilation system requires a discharge of about 170,000 cubic feet per minute (cfm) through 10 of the 11 registered ventilation stacks at any given time. (Stacks 296-A-5A and 296-A-5B do not operate simultaneously.) Approximately 80,000 cfm of the 170,000 cfm is discharged via the canyon exhaust system. Three electric motor driven canyon exhaust fans are available to maintain the necessary ventilation requirements. (A steam driven fan is available as a backup.) The remaining 90,000 cfm of exhaust air is discharged via various exhaust fans and stacks located throughout the facility.

Consolidation of the ventilation systems is recommended to minimize the volume of air discharged and the number of stack monitoring stations that must remain active following PUREX deactivation. The proposed plan is to cascade air from one ventilation system to another with eventual discharge of all air through the canyon and main stack. This ventilation configuration will allow shutdown and deactivation of all stacks except the main stack; will reduce the total

airflow discharged to about 40,000 to 60,000 cfm, and will allow possible isolation of the deep bed fiberglass filters from the final exhaust train. Isolation of the deep bed filters is desirable because the filters contain a large inventory of residual radionuclides and possibly some ammonia nitrate from past operations. The current and cascade ventilation concept is shown in Figures 1 and 2 respectively.

On-line equipment will be minimized by using a lower air flow with only one of the three canyon exhaust fans operating (the other two will be maintained as backups with the steam backup deactivated) and the supply fans off. To simplify equipment needs, the supply ducting will be used with induced draft. Most of the existing parallel ventilation flow paths will be eliminated by redirecting the air flow through three pressure zones including the P&O Gallery, the Sample Gallery, and the 673 foot elevation basement zones (Storage Gallery, Cells Q, M, and N, Product Removal Room, and Hot Shop). The Laboratory, Sample Gallery, and lower (673 foot elevation) building processing areas will be cleaned and decontaminated to a level which will minimize contamination problems.

Air will enter the P&O Gallery at the center by induced draft via the supply headers. Flow will be from the P&O center to the ends, where it will exit to the Canyon via the East Crane Maintenance Platform (east) and the White Room (west). Likewise, air flow will enter the sample gallery at the midpoint and will flow to the ends, where it will be redirected to the Canyon via existing stairwells. Ventilation of the 673 foot elevation zones will be accomplished by introducing air into the Storage Gallery which will flow toward the west end of the building and into the air tunnel openings located in M-Cell. Air will flow in series through Q-Cell, Product Removal Room Column 5 chase, N-Cell, Hot Shop and M-Cell.

As described above, the proposed activity for the Heating Ventilation and Air Conditioning (HVAC) modification involves the use of existing air flow pathways wherever possible. In order to ensure adequate airflow, additional air ducts will be required. Any supply and discharge pathways that are no longer needed will be blanked and sealed.

The methods used to perform the modification activities necessary to implement the cascade flow concept are similar as those used in the past for PUREX modifications and upgrades. Some of the ducting involved in this modification is contaminated. The levels of contamination have not been determined and cannot be quantified unless several penetrations are made at various duct locations. However, releases from the HVAC modification activities are not expected to be any greater than releases during past facility operations such as installation of the canyon exhaust fourth filter (HEPA), routine HEPA filter changes, decontamination of the canyon exhaust plenum and associated ducting, routine ventilation flow adjustments, main exhaust stack flushing, construction of the 292-AB Main Stack Sample Building and associated monitoring systems, maintenance and repair of fans, dampers, and associated controls, etc.

Figure 1: SIMPLIFIED EXISTING PUREX HVAC

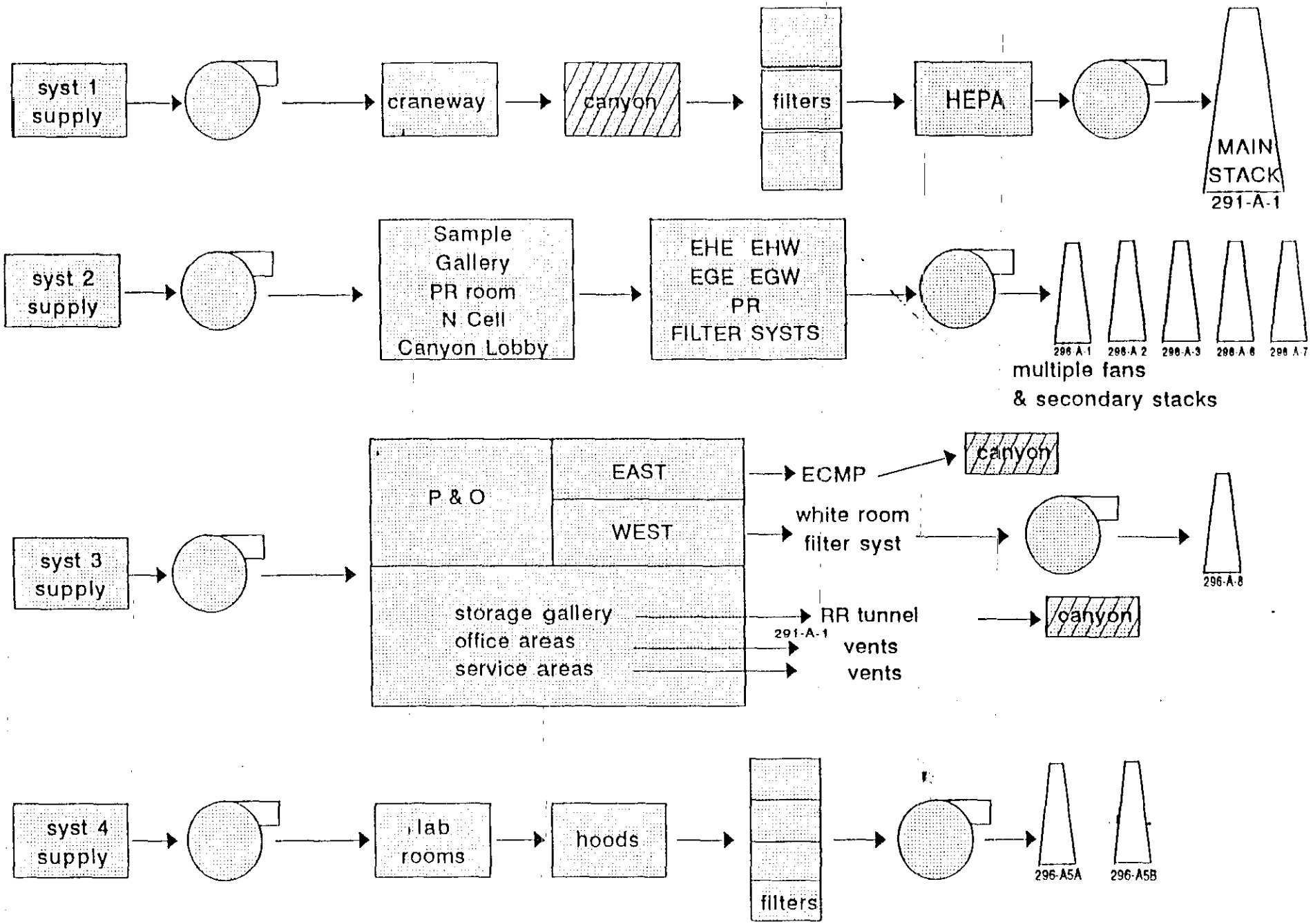
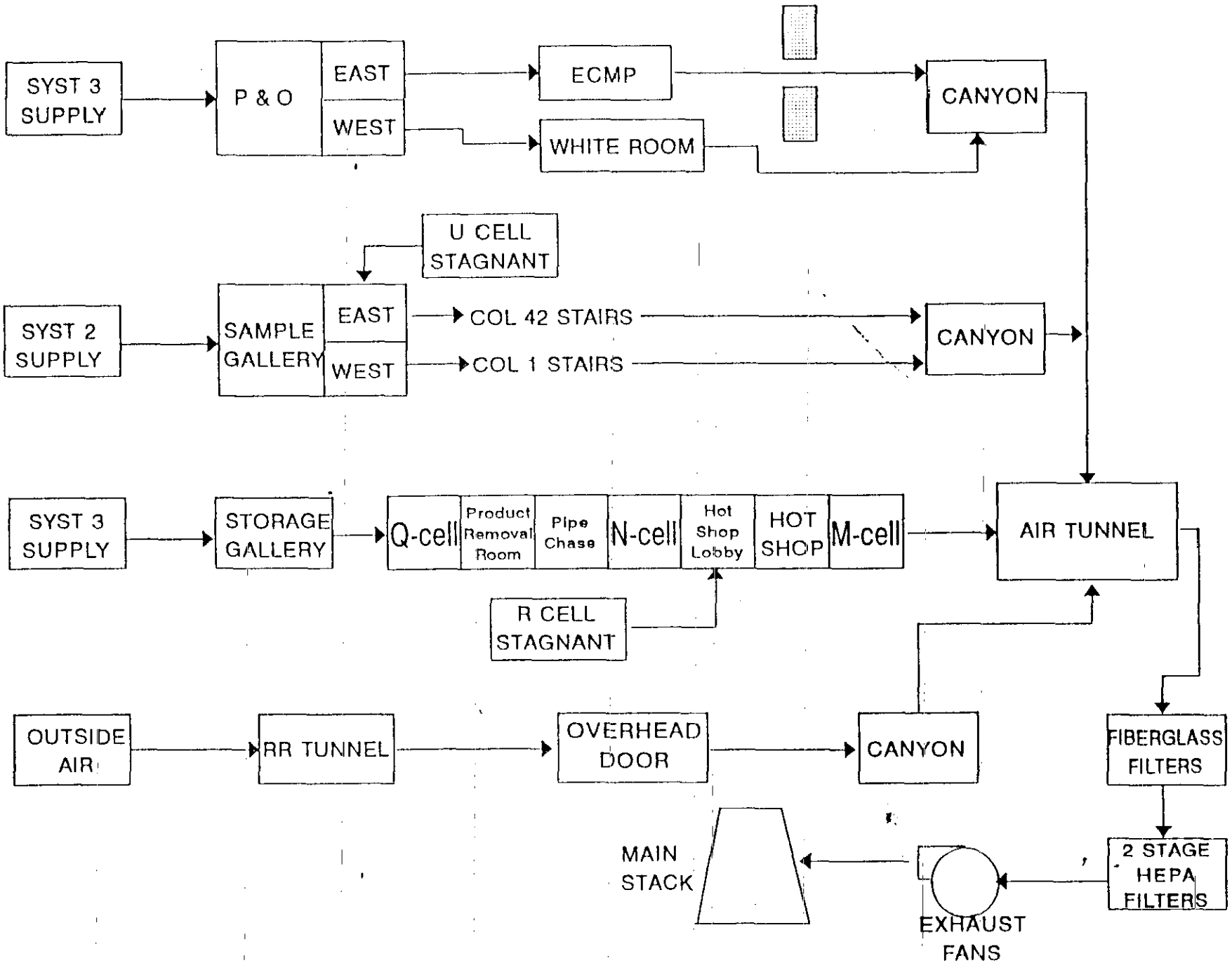


Figure 2: SIMPLIFIED REVISED HVAC FLOW SCHEME



The final tie-ins and switching of the HVAC system will not occur until all canyon deactivation activities are complete. Again, based on process knowledge and inventory data, it has been determined that there is no known source of TAPs associated with this activity. Therefore, no TAPs emissions are expected from this activity.

2.19 PUREX Laboratory Deactivation

The PUREX analytical laboratory will continue to provide support to other deactivation activities until no longer needed. At that time the laboratory will be deactivated by removing all chemical reagents and equipment. Any radiologically contaminated areas will be decontaminated using a "wet" process and/or stabilized by application of fixative agents (i.e. sealers and paints). Since chemicals inside the PUREX Laboratory are containerized, no TAPs emissions are expected from this activity.

3.0 Summary

The deactivation activities described in the PMP have been reviewed for the potential for the release of toxic chemicals to the atmosphere as a consequence of the proposed activities. No activities were discovered which would create a toxic materials release in excess of emissions in 1988 during normal plant operations. The only significant toxic chemical release expected as a result of deactivation activities is nitrogen oxides released by the sugar denitration disposal of nitric acid. This release will be below the level identified in PSD Permit PSD-X80-14.

4.0 REFERENCES

Coony, F. M., Thomas, S.M., (1989), Westinghouse Hanford Company Effluent Discharges and Solid Waste Management Report for Calendar Year 1988: 200/600 Areas," WHC-EP-0141-01, Westinghouse Hanford Company, Richland, WA.

WHC, 1993, PUREX/UO_3 Deactivation Project Management Plan, Report WHC-SP-1011D (Draft), Westinghouse Hanford Company, Richland, WA.

ATTACHMENT 2

Estimation of Nitrogen Oxides Emission Rate

The Project Management Plan indicates that approximately 208,000 gallons of 10 molar nitric acid is to be disposed of via the sugar denitration process. This is a batch process which treats 2500 gallon batches of nitric acid with sugar. Thus, approximately 84 batches would have to be processed to dispose of the entire 208,000 gallons. It has been estimated that a total of 252 days will be required and this works out to be 3 days per batch. This implies a treatment rate averaged over the three day period of 34.7 gallons/hour.

The normal strength of nitric acid treated by the sugar denitration process is 2.8 molar, thus the total amount of nitric acid per 2500 gallon batch of 10 molar acid is a factor of three higher than normal. The stated processing time of 3 days per batch is a little over 3.5 times longer than the normal processing time of 1 day per batch. As a result, the rate of NO_x release from the destruction process to be conducted will be comparable to the rate of NO_x release during normal fuel processing operations. The rate of NO_x production and release is limited by the rate of addition of 0.7 molar sucrose solution to the 94,630 mole batch of nitric acid. Based on previous process knowledge, one mole of sucrose is capable of destroying approximately 14 moles of nitric acid. The flow rate of the sucrose solution ranges from 0.46 to 0.65 gallons/minute. At the highest flow rate shown, it would require approximately 65 hours to add sufficient sucrose (6759 moles) to destroy all the nitric acid in a batch.

If a batch processing time of three days (72 hours) is assumed, since each mole of nitric acid produces 1 mole of nitrogen oxides, the NO_x molar generation rate will be 94,630/(72)(3600) = 0.365 moles per second. If all NO_x produced is in the form of NO_2 (worst case), then mass release rate or source term is:

$$(0.365)(46 \text{ g/mole}) = 16.8 \text{ g/s}$$

This source term was input to the EPI software which employs a Gaussian plume model to calculate downwind concentrations. This software calculated that with the emission coming from the 60 meter stack, the maximum downwind concentration occurred at a distance of 5 kilometers downwind, and concentration was only 0.014 ppm. Thus the maximum concentration is only a small fraction of the TLV/TWA for NO_2 which is set at 3.0 ppm. This results in the conclusion that nitric acid disposal does not generate an environmentally significant release.

ESTIMATED FUGITIVE EMISSIONS FROM PUREX ORGANIC SOLVENT TRANSFER

The projected fugitive emissions from transferring the PUREX solvent [75 Volume % normal paraffin hydrocarbon (NPH), 25 Volume % tributyl phosphate (TBP)] from Tank-G5 (TK-G5) and TK-R7 to a vendor tank truck was modeled as a liquid spill. The spill height was determined to be six feet: Five feet from the inlet pipe to the bottom of the tank; and one foot of equivalent spill height. The one foot of equivalent spill height was calculated by determining the height required for gravitational forces to accelerate the liquid to 80 gallons per minute (gpm) through a verticle two inch pipe. (80 gpm is assumed to be the maximum discharge rate into the tank.)

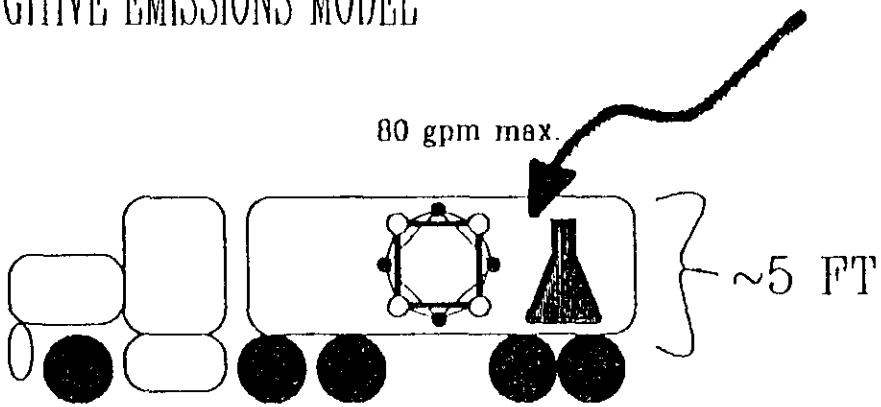
The model considered dropping a one gallon batch from a height of six feet. The one gallon volume was determined by calculating the volume of a cylinder of liquid, two inches in diameter and six feet high. This models the liquid falling from the two inch pipe into the tank more accurately than dropping a 2500 gallon volume all at once. The mass airborne from dropping one gallon was then multiplied by 2500 to represent a continuous spill into the tank per 2500 gallon batch. The amount of airborne TBP would be 28.59 milliliter (27.27 grams) per 2500 gallon shipment, or 228.71 milliliter (222.31 g) total.

The results from this model is very conservative for the following two reasons:

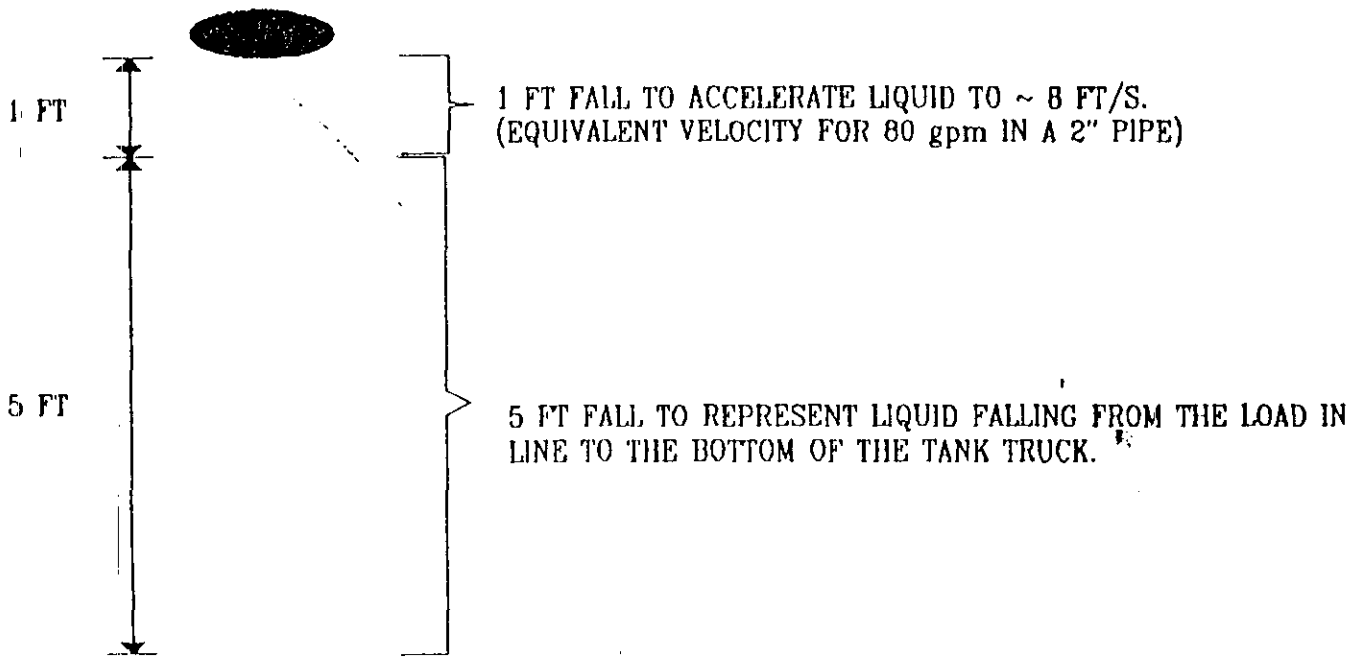
1. The airborne material would be contained inside the tank's air space and could only reach the environment through the tank's two inch vent line. The time required to fill the tank and displace the air through the vent line (approximately 1/2 hour) would allow time for a fraction to the airborne material to condense or settle back into solution

2. The spill height determines the amount of gravitational energy available to break up and rebound particles on impact. The spill height also influences the amount of time source material is exposed to shear forces during the fall; therefore, taller spill heights produce elevated airborne quantities. The model held the spill height constant at six feet when in reality the spill height would decrease as the tank truck filled.

ORGANIC FUGITIVE EMISSIONS MODEL



VENDOR SUPPLIED TANK TRUCK



ORGANIC MODEL CALCULATIONS

F = FRACTION AIRBORNE (DIMENSIONLESS)
ρ_{AIR} = AIR DENSITY, g/cm³
ρ_{LIQ} = SOLUTION DENSITY, g/cm³
ARCH = ARCHIMEDES NUMBER = $\rho_{LIQ}^2 h^3 g / \mu^2$
h = SPILL HEIGHT, cm
g = GRAVITY CONSTANT, cm/s²
μ = VISCOSITY, POISE
FR = FROUDE NUMBER = V^2/gR
V = IMPACT VELOCITY = $\sqrt{2gh}$, cm/s
R = RADIUS OF LIQUID DROP = $[(3/4)(1/\pi)(Vol)]^{1/3}$
Vol = VOLUME OF SOLUTION, cm³

EQUATIONS:

1.) $LOG_{10}\,\mu_{MIX} = N_{TBP}(1.345 + 0.36\,N_{TBP}) + N_{DIL}\,LOG_{10}\,\mu_{DIL}$

(PUREX TEC MANUAL p.

μ_{MIX} = VISCOSITY OF SOLVENT MIXTURE IN mP
N_{TBP} = VOLUME FRACTION of TBP IN MIXTURE
N_{DIL} = " " " NPH " "
μ_{DIL} = VISCOSITY OF DILUENT (NPH) IN mP

2.) $\rho_{MIX} = 0.972\,N_{TBP} + N_{DIL}\,\rho_{DIL}$

(PUREX TECH MANUAL p. 6-39)

3.) $\frac{P_a}{\rho} + \frac{g Z_a}{g_c} + \frac{u_a^2}{2g_c} = \frac{P_b}{\rho} + \frac{g Z_b}{g_c} + \frac{u_b^2}{2g_c}$

(BERNOULLI EQUATION

4.) $F = 6.31 \times 10^{-6}\,ARCH^{0.45}\left(\frac{\rho_{AIR}}{\rho_{LIQ}}\right)^{2.2} FR^{0.35}$

(NUCLEAR FACILITY ACCIDENT ANALYSIS HANDBOOK p. 4.

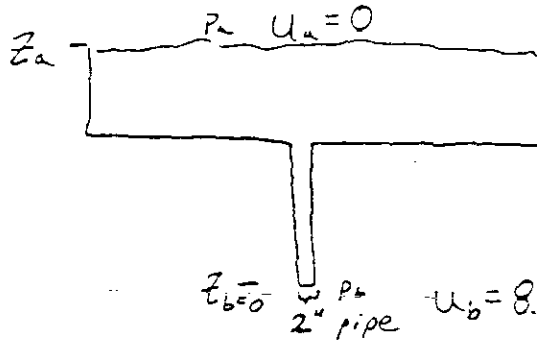
DETERMINATION OF EQUIVALENT HEIGHT

$$\frac{P_a}{\rho} + \frac{g z_a}{g_c} + \frac{u_a^2}{2 g_c} = \frac{P_b}{\rho} + \frac{g z_b}{g_c} + \frac{u_b^2}{2g}$$

($P_a = P_b$; $u_a^2 \approx 0$; $z_b \approx 0$)

$u_{MIX} = 18.45$ m/

$\rho_{MIX} = 0.81$ g/



$$z_a = \frac{u_b^2}{2g}$$

$$z_a = \frac{66.91\ ft^2/s^2}{2(32.17\ ft/s^2)} = 1.04\ ft$$

$$\simeq 1\ ft$$

$P_a = P_b$

SPILL HEIGHT = 5 ft + 1 ft

$$h = 6\ ft.$$

AIRBORNE CALCULATION:

(ANSWER WILL BE MULTIPLIED BY 2500 TO REPRESENT ONE TRUCK LOAD OF ORGANIC.)

$$ARCH = \frac{\rho_L^2 h^3 g}{\mu^2} = \frac{(0.81\ g/cm^3)^2 (182.88\ cm)^3 (981\ cm/s^2)}{(0.018)\ poise}$$

$$ARCH = 1.16 \times 10^{13} \text{ (DIMENSIONLESS)}$$

$$FR = \frac{V^2}{gR} = \frac{2gh}{\sqrt[3]{\left[\left(\frac{3}{4}\right)\left(\frac{1}{\pi}\right)(Vol)\right]}} = \frac{2(182.88\ cm)}{\left[\left(\frac{3}{4}\right)\left(\frac{1}{\pi}\right)(3{,}785.70\ cm^3)\right]^{1/3}}$$

$$FR = 37.83 \text{ (DIMENSIONLESS)}$$

$$F = (6.31 \times 10^{-6})\, ARCH^{0.45} \left(\frac{\rho_{AIR}}{\rho_{Li_0}}\right)^{2.2} FR^{0.35}$$

$$F = (6.31 \times 10^{-6})(1.16 \times 10^{13})^{0.45} \left(\frac{0.00118}{0.81}\right)^{2.2} (37.83)^{0.35}$$

$$F = 9.79 \times 10^{-6} \text{ (DIMENSIONLESS)}$$

MASS AIRBORNE $= (9.79 \times 10^{-6})(3{,}785.70\ g)$

$= 0.0370_5$ g / gallon dropped

$= 92.65$ g / 2500 gallons dropped

$= 114.38$ ml " " "

$= 0.114\ l_{AIRBORNE}$ " " "

$\times 8$ BATCHES

$= 0.915\ l$ ORGANIC AIRBORNE TOTAL

$\times 0.25$ (vol % TBP)

$= 0.228\ l$ TBP AIRBORNE

$= 228$ ml "

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Subject: REQUEST FOR CONCURRENCE WITH EMISSIONS EVALUATION FOR APPROVAL OF DEACTIVATION OF PUREX PLANT PURSUANT TO WASHINGTON ADMINISTRATIVE CODES 173-400 AND 173-460

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